

# PATENT SPECIFICATION

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## DRAWINGS ATTACHED

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## (54) IMPROVEMENTS IN LUBRICATING MECHANISM

(71) We, JOSEPH VÖGELE AG, of Neckarauer Strasse 168—228, 68 Mannheim 1, Germany, a German Company, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

THE INVENTION relates to a lubricating mechanism in particular for the stroke-synchronized lubrication of piston engines in which the intermittently-supplied lubricant is discharged to the lubricating point through a spring-loaded outlet valve placed in the vicinity of the lubricating point which valve is intermittently opened by the lubricant pressure and closed by the valve spring force.

In known, stroke-synchronized lubricating installations for internal combustion engines in which the lubricant feed is synchronized with the motion of the engine piston, the spring loaded outlet valve is seated in the engine cylinder wall so that the lubricant issuing at that point can be injected by the shortest path directly on to the piston skirt. The action of such a stroke synchronized lubricating arrangement has hitherto been controlled by regulating the passage of the oil through the lubricating pipe from the pump to the outlet. This form of control, however, gives no assurance that the requisite quantity of oil is in fact supplied to the engine piston skirt. For instance, the lubricating pipe could be leaky or by jamming or sticking of the outlet valve, the elastic expansion of the lubricating pipe could simulate a non-existent oil feed volume.

The present invention consequently has the object of eliminating these difficulties and so arranging the lubricating system that without the expenditure of considerable additional structural means absolutely reliable regulation of the lubricant supply is ensured.

This object is attained in accordance with the present invention by the provision of a pulse-emitting electrical sensing element controlled by the outlet valve spindle associated

with evaluating means releasing a warning signal should the emission of the said control pulses be interrupted.

The lubricant-feed controlling arrangement, in part provided by the outlet valve spindle itself, ensures that a warning signal is always emitted when lubricant fails to be sprayed from the outlet valve on to the piston skirt. The lubricant feed is thus directly controlled at the actual lubricating point.

A further object of the invention is an arrangement of the sensing means in such a manner that the free mobility of the outlet valve spindle remains unhindered by any mechanical or like transmitting means. As a further development of the invention it is consequently provided for a piezo-electric element to be interposed in series with the valve spring of the outlet valve and suitably between the said valve spring and the valve casing, which responds to variations in the valve-spring force by transmitting electrical pulse trains to the evaluating element.

Such provision of a piezo-electric regulating element eliminates all mechanical wear, since the said piezo-electric element responds only to the varying pressures on its surface, by which an electrical potential is controllably released. Apart from this, such a piezo-ceramic element has a practically unlimited service life and can easily be accommodated in any suitable place.

It is further proposed to arrange at least a preamplifier stage of the evaluating arrangement in direct proximity to the piezo-electric element. The pulses thus preamplified can no longer be influenced by any disturbing factor before reaching the evaluating arrangement.

The invention will now be described with reference to the exemplary forms of embodiment represented in the accompanying drawing, wherein:—

Figure 1 shows an engine cylinder in partial section with stroke-synchronized lubricating arrangement fitted thereon;

Figure 2 shows an outlet valve for the

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lubricant in longitudinal section on a larger scale; and

Figure 3 shows an alternative embodiment of such a lubricant valve in longitudinal section.

5 The stroke-synchronized lubricating arrangement represented in Figure 1 comprises a lubricating pump 1 delivering the lubricating oil through the feed pipe 2 to the outlet valve 3 from which it is directly  
10 sprayed on to the skirt 4 of the piston 5 in the engine cylinder 6. In order to ensure that the lubricating oil is delivered from the outlet valve 3 as far as possible directly at the lubricating point, the engine  
15 cylinder-wall is drilled with a number of holes 7 uniformly spaced along its periphery into which the valves 3 are screwed flush. The lubricating pump 1 runs intermittently in such  
20 a manner that the lubricating oil is delivered to the outlet valve or valves 3 during each piston stroke at the instant when the piston rings of the piston 5 are passing in front of the drilled holes 7. The pump plunger 8 of  
25 the lubricating pump 1 thus works with the same timing as the piston 5, this being attained in a manner such that the pump plunger 8 is driven off a camshaft 9 running  
30 synchronously with the engine crankshaft. The lubricating oil is fed to the pump plunger 8 from the lubricating-oil tank 10.

As shown in Figure 2, the valve 3 has a valve spindle 11 which is pressed by the  
35 spring 12 against the valve seating 13 in such a manner that the nozzle-shaped outlet orifice 14 for the lubricant is thereby closed. The lubricant issuing from the lubricating-oil feed pipe 2 passes through the drilled hole 15  
40 into the chamber (casing) 16 of the valve 3 and there acts on the annular face 17 of the said valve-spindle 11 in such a manner that the latter is lifted off the valve seating 13 against the force of the ((valve) spring  
45 12. This causes the lubricant to be sprayed out of the valve 3 through the nozzle-shaped outlet aperture 14 on to the skirt 4 of the piston 5. As soon as the pressure pulse of the intermittently-running lubricating oil  
50 pump 1 is interrupted, the valve spindle 11 is returned into its closed position by the action of the valve spring 12, whereby the outlet aperture 14 is again closed. This opening (of the valve) and spraying of the lubricant, actuated by the lubricating oil pressure and ensuing closing thereof by the force of the  
55 valve spring 12 is repeated at each stroke of the (engine) piston 5.

To allow the lubricant feed to be controllably regulated directly at the lubricating  
60 point, the invention provides for an electrical sensing element 18 fitted in the valve 3 which responds to the motions of the valve spindle 11 and transmits corresponding pulses to an evaluating element 19 connected in series  
65 therewith. The sensing element comprises a

piezo-electric element suitably of sintered ceramic, fitted between the valve spring 12 and the valve body wall 20. This piezo-element generates an electrical pulse whenever the pressure acting on the surface 21 changes.  
70 This pressure change takes place when the valve spindle 11 is raised by the lubricant against the force of the valve spring 12 from the valve seating 13 and the lubricant is sprayed out; since the valve spring 12  
75 is thereby compressed and the increased valve pressure thereby generates an electric pulse in the piezo-element 18. The evaluating element 19 is connected with the piezo-electric element 18 through the conductor lead 22,  
80 entering the valve body from the outside and the further conductor lead 23. On cessation of the electric pulses, the warning element 24 of the evaluating unit 19 emits a signal indicating cessation of the motion of the  
85 valve stem and thereby of the lubricant feed. The control unit is set in action by the switch 25. The preamplifier 26 of the evaluating unit 19 is directly fitted in the valve body 3 in immediate proximity to the piezo-element  
90 18, so that disturbing influences are excluded.

In the valve embodiment according to Figure 3, the valve spindle 11 opens in the opposite direction, i.e. by moving outwards, for which a suitably-modified arrangement of the piezo-element 18 inside the valve body 3 is required. In this form of the valve, the  
95 lubricant pressure acts on the conical face 27 of the valve spindle 11, whereby the latter is opened in the outflow direction against the pressure of the spring 12. The piezo-electric element 18 is in this case in the form of a ring through which the stem of the valve  
100 spindle 11 presses. It bears on the outlet side of the valve against the end face 28 of the valve body and on the opposite side against the spring plate of the valve spring 12. Here too, the varying valve-spring pressure is transmitted in the form of electric  
105 pulses over the conductor 23 and 22 to the evaluating unit 19.

#### WHAT WE CLAIM IS:—

1. A lubricating mechanism wherein intermittently-fed lubricant is delivered to a lubricating point by a spring-loaded outlet valve  
115 fitted in proximity to the said lubricating point and which is intermittently opened by the pressure of the lubricant and closed by the valve-spring force and wherein electrical sensing means emitting pulses controlled by the  
120 motions of the outlet valve spindle are associated with evaluating means releasing a warning signal on interruption or cessation of the said pulses.

2. A lubricating mechanism as claimed in claim 1, wherein the sensing means comprise  
125 a piezo-electric element which is fitted in the outlet valve in series with the valve spring between the valve spring and the valve body,

and which transmits electric pulses to the said evaluating means according to the variation in the valve spring pressure.

3. A lubricating mechanism as claimed  
5 in claim 2, wherein a preamplifier of the evaluating means is fitted in direct proximity to the piezo-electric element.

4. A lubricating mechanism as claimed in  
10 claims 2 or 3, wherein the piezo-element is a sintered ceramic element.

5. A lubricating mechanism as claimed in

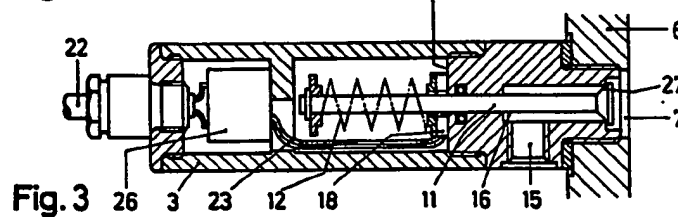
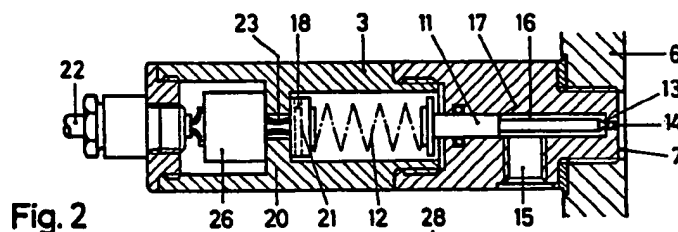
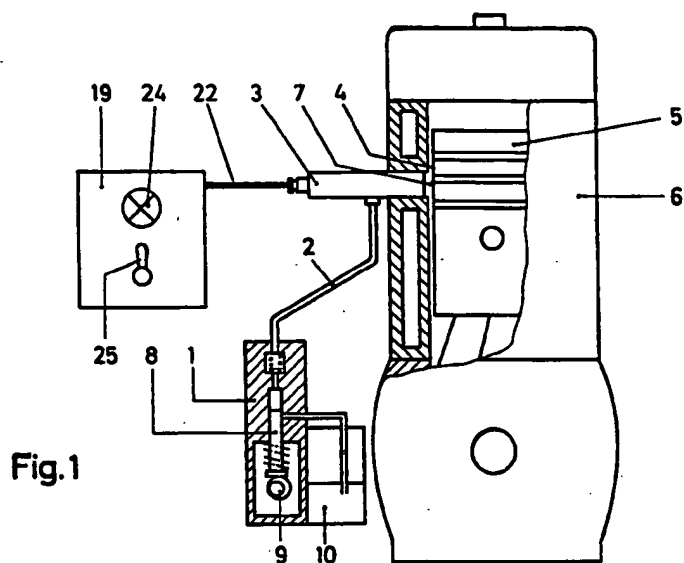
any one of claims 1 to 4, in combination with a piston engine for the stroke-synchronized lubrication thereof.

6. A lubricating mechanism substantially as  
15 herein described with reference to the accompanying drawings.

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